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(58) Field of search

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(54) Particle separator

(57) An apparatus for separating solid particles from flue gases (e.g. from a fluidised bed reactor (1), comprises a separation chamber (3) provided with a wall (4) in which there is a plurality

of orifices (8) located a distance apart from each other in the flow direction of the gas, through which orifice gas is removed in a direction substantially deviating from the main flow direction of the gas. Preferably the wall (4) is straight in the main flow direction and is cooled.

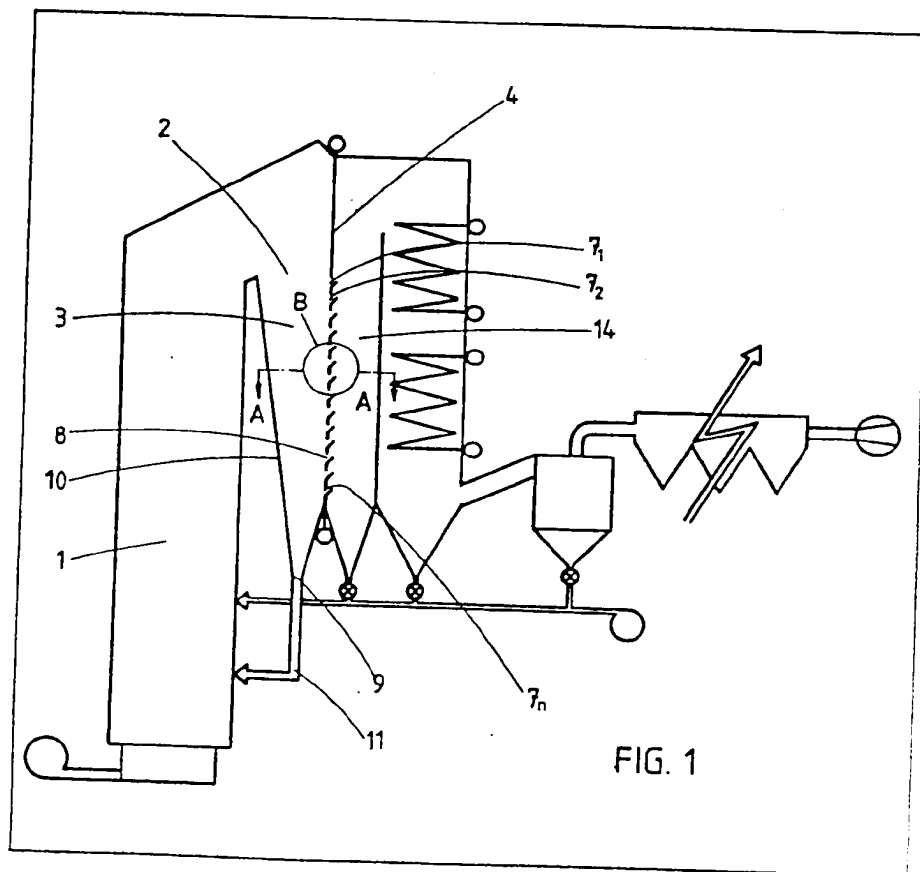
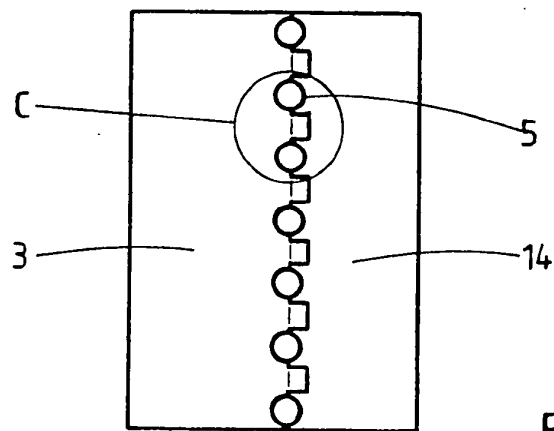
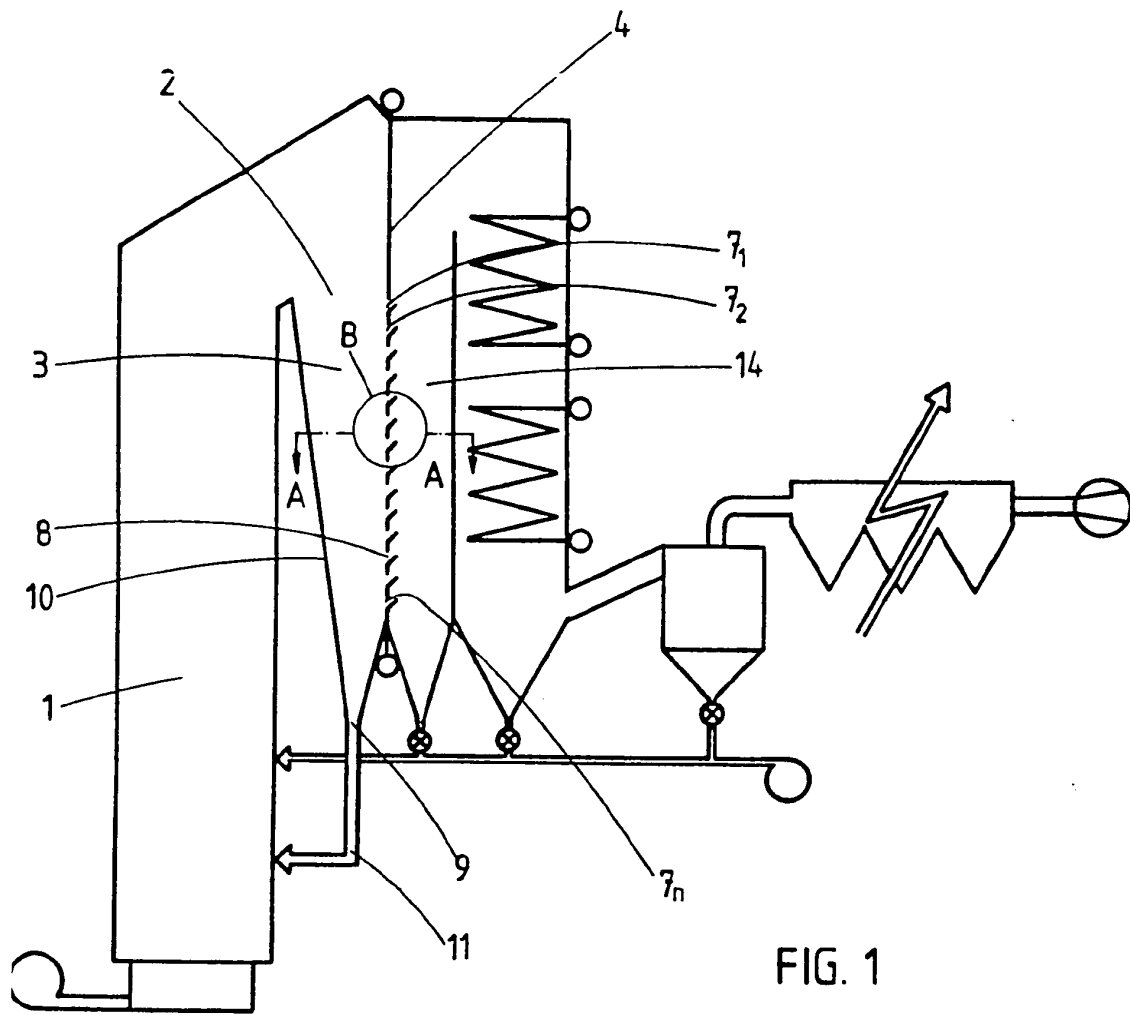


FIG. 1

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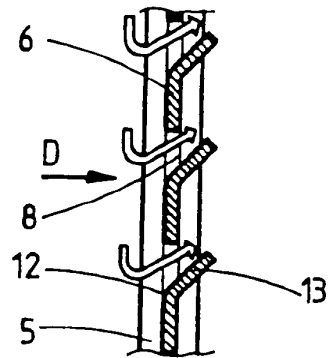


FIG. 3

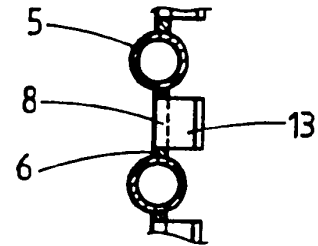


FIG. 4

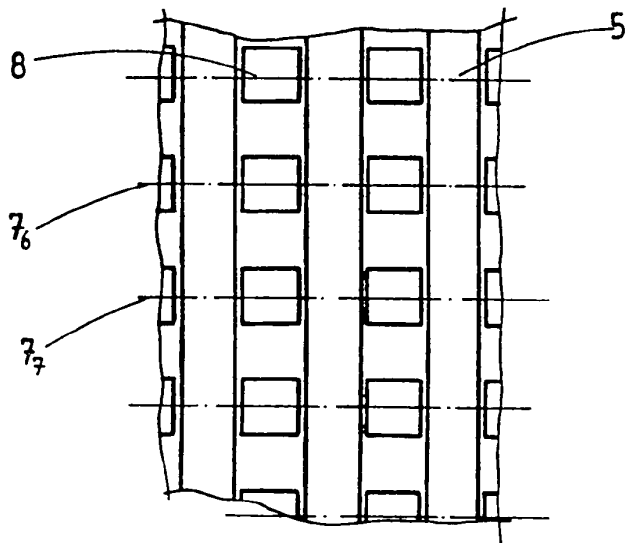


FIG. 5

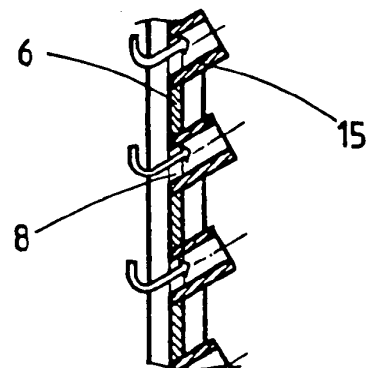


FIG. 6

SPECIFICATION

Apparatus for removing solid components from flue gases

The present invention relates to an apparatus
5 for removing solid components from flue gases,
which is particularly suitable for the treatment of
flue gases from a fluidized bed reactor in which
the solid particles separated from the flue gases
are recirculated into the fluidized bed reactor.

10 In fluidized bed reactors of this kind the
separation of solids has earlier been performed in
cyclone separators. The disadvantage of a cyclone
separator is the fact that it requires a lot of space.
Its bulk is also big and therefore its thermal
15 capacity is high, wherefore the running down and
up of the reactor is time-consuming. The form of
the cyclone separator causes thermal stresses
which are difficult to control. Also the wearing of
the apparatus causes problems.

20 U.S. Patent 4,253,425 discloses a fluidized bed
reactor in which the flue gases are caused to flow
through a channel provided with baffles changing
the flow direction, whereby solid particles are
separated when the flue gases impinge against
25 the baffles and the solids fall down into the lower
part of the reactor, from where they are returned
to the reactor. The suggested apparatus does not,
however, provide efficient removal of solids from
gases.

30 The object of the present invention is to provide
an apparatus having a simple structure for
efficient separation of solids from the gas flow.

It is another object of the invention to provide
an apparatus by means of which heat can be
35 recovered from a hot gas flow.

An apparatus according to the invention is
primarily characterized in that the separation
chamber comprises a wall provided with a
plurality of orifices disposed a distance apart from
40 each other in the flow direction of the gas, through
which orifices gas is removed in a direction
substantially deviating from the main flow
direction of the gas.

The invention will be described further, by way
45 of example, with reference to the accompanying
drawings in which:—

Fig. 1 is a schematic cross-sectional view of a
fluidized bed reactor provided with a separator
according to the invention;

50 Fig. 2 is a section as on the line A—A of Fig. 1;
Fig. 3 is an enlarged view of point B in Fig. 1;

Fig. 4 is an enlarged view of point C in Fig. 2;

Fig. 5 shows the point illustrated in Fig. 3 seen
in the direction of arrow D; and

55 Fig. 6 shows an alternative embodiment
corresponding to Fig. 3.

60 Flue gases discharged from a fluidized bed
reactor 1 illustrated in Fig. 1 are conveyed through
an inlet opening 2 to a separation chamber 3. One
wall 4 of the separation chamber is formed, as is
shown in Figs. 2 to 5, by a plurality of parallel
vertical tubes 5 and plates 6 connecting adjacent
tubes. The tubes are connected to the
water/steam system of the reactor in a manner

65 known per se, and they act as heat transfer
surfaces through which the flue gases transfer
heat to a medium flowing in the tubes. Several
rows 7₁, 7₂, 7_n of orifices 8 are disposed a
distance apart from each other in the flow
70 direction in the plates. In the lower portion of the
separation chamber there is a discharge opening 9
for solid particles. The opposite wall 10 of the
separation chamber is disposed obliquely with
regard to the wall 8 so that the diameter of the
75 separation chamber decreases towards the
discharge opening 9. The discharge opening 9 is
by means of a tube 11 connected to the bottom
portion of the fluidized bed reactor. Guide blades
13 which are directed obliquely upwards are
80 disposed in connection with the front edges 12 of
the orifices 8 on the outlet side of the orifices.
The outlet orifices lead to an outlet channel 14.

The flue gases from a fluidized bed reactor
which contain solid particles flow downwards in
85 the separation chamber along wall 3 towards the
discharge opening 9 for solid material. Gas is
discharged from the orifices 8. The discharged
gas flows under guidance of the guide blades 13
obliquely upwards to the outlet channel 14 in
90 which the gas flows upward. Due to the sudden
change in the direction of the gas, the solid
particles which continue their movement forward
in the main flow direction, are separated. In order
to obtain efficient separation, a high velocity has
95 to be maintained in the separation chamber.
Therefore the separation chamber is formed so
that it narrows down towards the outlet openings
9 for the separated solid particles. The separated
solids are returned to the lower part of the reactor
100 through the tube 11. After the outlet channel the
gases are cooled in a manner known per se and
the solids remaining in the gases after the primary
separation performed in the separation chamber
are removed.

105 Fig. 6 illustrates an alternative embodiment,
wherein tube-like guide means 15 directed
obliquely upwards are disposed in connection with
the orifices 8 in the plates 6 on the outlet side of
the orifices.

110 A separator according to the invention may
perhaps not be as efficient as a cyclone separator,
but this is just an advantage, as eventual heat
surfaces in the gas flow after the separator are
kept cleaner due to the sweeping effect of the
115 solid particles.

The invention is not limited to the specific
embodiments shown, but it can be modified
within the scope of the claims. Thus the
separation chamber may have several walls
120 through which gas is removed to several outlet
channels. Guide means changing the flow
direction of the gases may be disposed also on the
incoming side of the gas discharge orifices.

CLAIMS

125 1. An apparatus for separating solid particles
from a gas flow, comprising a separation chamber
provided with outlet openings, characterized in
that the separation chamber is provided with a

- wall having a plurality of orifices disposed a distance apart from each other in the flow direction of the gas, through which orifices gas is removed in a direction deviating substantially from the main flow direction of the gas.
- 5 2. An apparatus according to claim 1, characterized in that the wall is straight in the flow direction.
- 10 3. An apparatus according to claim 1 or 2, characterized in that guide means are provided in connection with the gas discharge orifices.
- 15 4. An apparatus according to claim 3, characterized in that the guide means are disposed on the outlet side of the gas discharge orifices.
5. An apparatus according to claim 3 or 4, characterized in that guide blades are disposed in connection with the front edge of the gas discharge orifices.
- 20 6. An apparatus according to any of claims 1 to 5, characterized in that the gas discharge orifices are disposed in plates connecting adjacent cooling tubes.
- 25 7. An apparatus according to claim 1 or 7, characterized in that the separation chamber narrows down towards the outlet for separated solid particles.
- 30 8. An apparatus according to any of claims 1 to 7, characterized in that the gas discharge orifices lead to channel in which the flow direction of the gas is opposite to that of the gas flowing in the separation chamber.
- 35 9. An apparatus for removing solid components from flue gases constructed and arranged to operate substantially as herein described with reference to and as illustrated in the accompanying drawings.